

DIRECT TESTIMONY

OF

BRUCE A. LARSON P.E.

ELECTRIC SECTION - ENGINEERING DEPARTMENT

ENERGY DIVISION

ILLINOIS COMMERCE COMMISSION

**Petition for approval of delivery services tariffs and tariff revisions  
and of residential delivery services implementation plan and  
for approval of certain other amendments and additions to its rates,  
terms and conditions.**

**Commonwealth Edison Company**

**Docket No. 01-0423**

August 23, 2001

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- Q. Please state your name and business address.
- A. My name is Bruce A. Larson. My business address is 527 East Capitol Avenue, Springfield, Illinois 62794-9280.
- Q. By whom are you employed and in what capacity?
- A. I am a Senior Energy Engineer in the Electric Section, Engineering Department, Energy Division of the Illinois Commerce Commission ("Commission").
- Q. Please describe your education and professional background.
- A. I received a Bachelor of Science Degree in Electrical Engineering from Purdue University in December 1975. I am a Registered Professional Engineer in Illinois. I joined the Staff of the Illinois Commerce Commission ("Staff") most recently in January 1990. My past employment includes two years with Public Service Company of Colorado and five years with Hagler Bailly, a consulting firm.
- Q. Have you previously testified before a regulatory body?
- A. Yes, I have previously testified before this Commission and similar government bodies in Colorado, Indiana, Ohio, Pennsylvania, Arizona and Connecticut.
- Q. What is the purpose of your testimony?
- A. The purpose of my testimony is to present my review of the prudence of ComEd's distribution construction activities for the period starting August 1999. Both internal and external audits revealed that many parts of ComEd's

25 distribution infrastructure were woefully inadequate. [Beginning in August 1999,](#)  
26 ComEd began an unprecedented construction and maintenance program to  
27 upgrade its facilities. Goals were set to install as much capacity as possible  
28 before the summer of 2000, and again for the summer of 2001. In many  
29 instances, premiums were paid by ComEd for early completion of projects, either  
30 in the form of higher payments to contractors or overtime pay to ComEd  
31 employees.

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33 Q. Could you identify the audit reports you spoke of previously?

34 A. Yes. The reports I primarily relied upon are the "Transmission and Distribution  
35 Investigation Report" by ComEd, dated September 15, 1999 and the "First  
36 Report of the Investigation of Commonwealth Edison's Transmission and  
37 Distribution Systems", by Liberty Consulting dated June 2000. I also reviewed  
38 several of the quarterly progress reports, primarily to explore the costs that were  
39 incurred.

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41 Q. Could you briefly summarize the reports?

42 A. Yes. The Liberty Report found that ComEd's primary criterion for distribution  
43 expenditures in the 1990s was to minimize cost. Equipment loadings were  
44 allowed to become very high, which meant that, among other things, in case of a  
45 failure of one piece of equipment, ComEd could not switch the load to other  
46 equipment without overloading the alternative equipment. In addition, ComEd  
47 allowed a large backlog of maintenance, which increased the probability of an

48 outage, with each outage representing the collapse of the house of cards that  
49 ComEd's system had become.

50  
51 It is easy to understand that, as the loading of transformers increases, more and  
52 more equally highly loaded transformers are required as backup. A transformer  
53 loaded at 50% needs only one other transformer, also loaded at 50%, as backup.  
54 A transformer loaded at 80% needs **four** other transformers, also loaded at 80%,  
55 as backup. ComEd routinely expected numerous transformers to carry loads in  
56 excess of 100%. Obviously, if one of these transformers failed, service  
57 interruptions were likely.

58  
59 ComEd's own report, "Transmission and Distribution Investigation Report",  
60 released September 15, 1999, also known as A Blueprint for Change, states:

61 The major findings reveal serious issues in the transmission and  
62 distribution system, especially in the areas of system maintenance,  
63 planning and design. (Emphasis in original)

64 ...

65 ComEd must:

- 66 • **Find the problems in the design and**
- 67 **maintenance of the entire system;**
- 68 • **Face the problems with clear management**
- 69 **accountability; and**
- 70 • **Fix the problems so customers across the**
- 71 **system receive service which meets and**
- 72 **exceeds industry norms. (Emphasis in original)**
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75  
76 The report made five recommendations. The recommendations are as follows,  
77 starting at page A.11.

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79 **(1) Maintenance:** As the tortured summer saga of Line 5348 suggests,  
80 the investigation found that a utility like ComEd needs to be painstaking in  
81 the care and feeding of its T&D components. The team found that other  
82 major cities operate T&D equipment that is no newer, no older – not  
83 fundamentally different from ComEd's. The task force findings pinpoint  
84 the crucial difference between ComEd's equipment – which failed this  
85 summer – and similar systems elsewhere that did not: ComEd has been  
86 unable to provide the rigorous care and maintenance that the T&D system  
87 requires for optimal reliability.  
88

89 It was generally found that while ComEd's inspection programs seemed  
90 appropriate, there were only imperfect mechanisms in place to ensure  
91 execution. It looked good on paper, but the repeated outages made the  
92 truth of the matter painfully clear. It is not certain, from a review of the  
93 records, how often inspections were actually performed, and the  
94 inspections that were performed may have been too passive, too cursory,  
95 to truly maintain the system.  
96

97 Additionally, the Report concludes that ComEd needs to ensure better  
98 follow-up on maintenance requests. While virtually all T&D emergencies  
99 are dealt with immediately, there appear to be altogether too many  
100 deficiencies which, had they been identified and addressed sooner, would  
101 not have become critical in the first place. Too often, the priority of  
102 requests for maintenance was not recognized, and the request was simply  
103 added to a list. The Report also indicates that routine maintenance  
104 requests on the list were rarely tracked to ensure follow-up, and that the  
105 list was rarely updated to indicate which requests had already been  
106 addressed.  
107

108 Specifically, the Investigation Report presents the following findings about  
109 ComEd's maintenance program:  
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- 111 • Management Systems. ComEd's maintenance program is hampered  
112 by incomplete definition, lack of focus, historic budget swings,  
113 suboptimal work planning and inconsistent supervision.  
114
- 115 • Equipment Monitoring and Capacity Management. Too much of  
116 ComEd's maintenance work is reactive rather than preventive, driven  
117 by actual or pending equipment failures, because of insufficient  
118 monitoring and inadequate capacity (monitoring and capacity are  
119 discussed separately below).  
120

- Program Execution. ComEd's maintenance program has been hindered because of gaps in equipment condition monitoring, inconsistent training and work practices, and unclear priorities.
- Recordkeeping and Documentation. ComEd maintenance efforts are often made more difficult by incomplete operating histories of components due to gaps in data capture, inattention to detail, and lack of workforce discipline.

ComEd's report continues, at page A.12.

**(2) Equipment Protection and Monitoring:** As mentioned above, ComEd's physical equipment is largely comparable to that of other utilities in major metropolitan areas. In addition to improving its maintenance practices, however, ComEd needs to strengthen its equipment monitoring and protection. By improving its monitoring practices, ComEd will be better able to predict when certain types and pieces of equipment are likely to wear out or fail. Predicting (and thus preventing) the on-line failure of a component helps protect the equipment around it: when one component fails, the power originally carried by that component must travel through alternative routes using the surrounding components. This is what happened on July 30, when the sudden overload caused by the failure of Line 5348 acted to shut down the adjacent transformers.

Specifically, the Investigation Report presents the following findings about ComEd's equipment protection and monitoring:

- Maintenance Program Ownership. It was not always clear who was responsible for specific elements of ComEd's protection and monitoring program. Even when the responsible party was clearly identified, he or she was not always held accountable, in a meaningful way, for the performance of those elements.
- Calibration Maintenance. ComEd has not kept pace with the necessary relay calibrations, and its efforts to do so are hampered by the same types of issues described above with respect to other types of systems maintenance.
- Root Cause Analysis. ComEd has not effectively tracked and analyzed information about relay failures, and thus cannot analyze or address the root causes of those failures.
- Equipment Condition Monitoring. ComEd has not implemented a consistent program of equipment monitoring across its system, thus limiting its ability to detect incipient failures.

The ComEd report continued at page A.13.

**(3) T&D Load and Capacity:** It is obvious from the system failures this summer that the ComEd power delivery system is overloaded at some points. ComEd was aware that certain substations were overloaded at times of peak summer demand and was working to address the situation as outlined in its agreement with the City of Chicago. But the recent investigation revealed that the extent of the problem had been underestimated. ComEd's experts calculate that the T&D system is five to ten percent deficient in its capacity to carry the peak load, which must be contemplated in the wake of this summer's experiences. The problem is not a lack of power. Between construction, importation and its fleet of nuclear plants, ComEd expects to have a sufficient supply of power. The problem is that the distribution system cannot reliably deliver the power to its customers at peak times. ComEd needs to redesign some parts of its system to make better use of the physical components that are already in place, and invest in greater capacity to help it carry the load.

Specifically, the Investigation Report presents the following findings about the load and capacity of ComEd's T&D system:

- Substation Capacity. Upon initial review, it appears that almost a third of ComEd's large substations (approximately 73) operate above capacity at time of peak demand, and that 27 of those substations require expedited corrective actions. Three of those 27 substations are located in the City of Chicago (Crosby at 1180 North Crosby, Lakeview at 1141 West Diversey, and Northwest at 3501 North California), and 24 are located outside the City.
- Distribution Feeder Capacity. Upon initial review, it appears that almost one fifth of ComEd's small substations and feeders (approximately 880) operate above capacity at times of peak demand; 185 of those small substations and feeders are located in the City.

The ComEd report continues at page A.14.

**(4) T&D System Optimization:** The distribution system serving downtown Chicago has evolved over the years to a condition that is particularly sensitive to inaccuracies in planning and the impacts of maintenance outages and equipment failures. Its apparent radial design is really an arrangement of radial arms of electrical loops similar to that employed in many highly reliable European designs, except with less capacity and configuration redundancy. It is the uniformly high loads carried on the system and the limited load transfer capability which combine to make this an unforgiving situation. Additionally, the ComEd

system was found to contain some unique and limiting features which compound the impact of equipment outages and failures.

Achievement of improved service reliability will require the careful balancing of capacity additions and configuration enhancements.

Specifically, the Investigation Report presents the following findings about the load and capacity of ComEd's system design:

- System Design. ComEd's downtown distribution system lacks some of the features which provide high reliability and flexibility in other US and European designs.
- Delivery Capacity. Additional power delivery capacity is needed to provide the operating flexibility and contingency management capability needed to ensure highly reliable service.
- System Operation. Traditional contingency planning criteria applied to this system will not provide the requisite reliability for such an important area.

And finally, the ComEd report continues at page A.15.

**(5) Organization and Management:** As the results of the investigation have unfolded, a wide variety of underlying organization and management issues have surfaced. A series of realignment workshops used to establish the transition organization for T&D (as described below) identified further evidence of the same issues, confirming the findings of the investigation with respect to organization and management issues. The issues identified in the Report fall into five categories, all related to just "doing the work": leadership, organization design, work processes, information systems and staff.

Q. What conclusions can be drawn from ComEd's report?

A. In my opinion, it is apparent from ComEd's report and from the Liberty report that ComEd failed to adequately plan and maintain their distribution system. When this negligence finally caught up with ComEd and things began to fail, ComEd needed to take extraordinary actions to upgrade and get its distribution system back in shape in as little time as possible. This



involved contracting with many different firms and paying premiums for much of that work, and having ComEd workers put in many thousands of hours of overtime. I believe that if ComEd had been adequately maintaining and planning their distribution system all along, the work that was done could have been done in a controlled manner, over a longer period of time at a lower cost.

Q. Are the premiums ComEd paid to contractors and additional overtime pay to ComEd employees prudent?

A. No. While finishing the work quickly was important and probably prudent, given the situation ComEd was in, ComEd should have been making these expenditures earlier. In other words, ComEd was not prudent to neglect its distribution system such that the system was unable to reliably serve the load that customers demanded. ComEd's situation on this issue is comparable to that of CILCO's Springfield natural gas distribution system back in the early 1990's. (see Docket No. 94-0040.) CILCO had deferred maintenance and repair of its cast iron mains in the City of Springfield to the point where it was no longer able to safely perform its function to deliver gas. CILCO management that was directly responsible for the cast iron mains knew of the deteriorated state of the mains, but did nothing. When CILCO upper management was made aware of the magnitude of the problem, CILCO, like ComEd, mounted a massive reconstruction effort. Outside contractors were brought in and CILCO workers

performed many hours of overtime. The cast iron mains were replaced in an expedited fashion on a compressed schedule.

That issue was addressed in Docket No. 94-0040. The Order states:

The Commission rejects CILCO's arguments to the contrary and finds that allowing the Springfield system to deteriorate to the point of creating a public safety hazard necessitated an accelerated renewal program which led to a level of expenditures that would not normally be required had CILCO been conducting business in a reasonable prudent manner.

The Commission is of the opinion that such a course of conduct requires the disallowance of some of the expenses associated with the Springfield renewal program. (Order at 15.)

In my opinion, ComEd allowed its distribution system to deteriorate to the point of creating a public safety hazard. Inoperative traffic signals, elevators, air-conditioners, and slowed public transportation are a public safety hazard.

Q. How do you propose to adjust for ComEd's past imprudent actions?

A. That is a difficult question. I would like to perform the analysis in the same fashion as in Docket No. 94-0040. However, the situation with ComEd is somewhat different in that ComEd's problems were due not only to a lack of maintenance, but also due to a lack of upgrading the system to meet increased loads. Therefore, I believe ComEd should have performed the work that they did during 1999, 2000 and 2001 prior to that period. In the CILCO matter, the Commission found that had CILCO been performing maintenance on the Springfield system, the system would have been adequate to allow a controlled cast-iron main replacement program to begin at a later time. With ComEd, I do

not know a precise schedule for the installation of all of the equipment ComEd should have installed throughout the 1990s. Knowing the proper timing is required because the method in 94-0040 adjusted for both the time value of money and inflation. Therefore, I invite ComEd to propose a reasonable schedule over which they would have performed the system upgrades had they been properly maintaining and planning their system.

ICC Staff Ex. 9.1 shows ComEd's major expenditures from 1998 through 2000 and projections for 2001. The first row shows ComEd's capitalized straight time for distribution plant. The second row shows ComEd's capitalized overtime for distribution plant.

I propose limiting capitalized overtime for ComEd construction to the level of 1998. That represents approximately \$40 million from 1999 through 2001. This is to reflect the fact that had ComEd rebuilt their system in a timely and controlled manner, there would not have been nearly as many overtime hours. Since the \$40 million is primarily time and a half, one-third of that is my proposed disallowance, or \$13,329,000.

For ComEd's largest outside contractor, Asea Brown Boveri, ("ABB"), ComEd negotiated a contract that included incentive payments for completing construction in an expedited time period. I propose to disallow these amounts because ComEd should have known that these facilities were needed before

August of 1999, and could have contracted at appropriate earlier dates to build them at normal costs. The premium, expedited costs are totally a result of ComEd's imprudence in not maintaining and planning their system. The total amount for ABB and incentives for four other contracts is \$14,530,584. The ABB portion is \$13,444,038. Depreciation expense should also be reduced pursuant to both adjustments.

Q. Do your adjustments remove all imprudent costs from ComEd's rates?

A. No. There are many other areas where I believe ComEd's imprudence led to increased costs. First, ComEd added numerous 138 kV transformers to increase its distribution system capacity. These transformers are generally long lead-time pieces of equipment. ComEd may have paid a premium for these transformers for delivery of so many in such a short time. I have not attempted to quantify this amount. Second, during the high heat of July of 1999, many pieces of equipment failed catastrophically or otherwise experienced a shortened lifespan from overloading. I have not made adjustments for these failures or loss of life. And third, many of the other outside contracts, while not having specified incentives for early completion, may have simply required early completion. There are likely many other areas where the immediate need for equipment and materials probably resulted in ComEd having to pay higher costs. In addition, it is likely that a more controlled program over a longer time period would have been far easier to manage and resulted in more efficient project management. Finally, many of the contracts were sole source contracts as opposed to competitively bid

348 contracts. Sole source contracts can be entered into more quickly than  
349 competitive bids, but are generally unfavorable to the buyer.

350

351 Q Does this conclude your testimony?

352 A. Yes.

Distribution Plant Expenditures  
(\$1,000)

ICC Staff Exhibit 9.1

	1998	1999	2000	2001	98-01	99-01	Source
ComEd							
Straight Time	\$ 68,635	\$ 50,706	\$ 65,585	\$ 65,585	\$ 250,511	\$ 181,876	GEG 2.02
Overtime	\$ 12,840	\$ 25,114	\$ 26,695	\$ 26,695	\$ 91,344	\$ 78,504	GEG 2.02
Subtotal	\$ 81,475	\$ 75,820	\$ 95,039	\$ 95,039	\$ 341,855	\$ 265,898	
Proposed Disallowance		\$ 4,091	\$ 4,618	\$ 4,618	\$ 13,328		
Outside Contracts	\$ 40,255	\$ 77,165	\$ 203,643	\$ 203,643	\$ 524,706	\$ 484,451	GEG 2.07(1)
Capitalized Total	\$239,191	\$297,322	\$ 688,348	\$ 160,000	\$ 1,384,861	\$ 1,145,670	BAL 1.04

(1) Labor and Material